

$$\begin{aligned}
 l_x &= \int_x^\omega l_t \mu_t dt, & l_x &= l_0 \exp\left\{-\int_0^x \mu_t dt\right\} \\
 {}_n p_x &= \exp\left\{-\int_x^{x+n} \mu_t dt\right\} = \exp\left\{-\int_0^n \mu_{x+t} dt\right\}, \quad \forall n \\
 {}_n q_x &= \int_0^n {}_t p_x \mu_{x+t} dt, \quad \forall n
 \end{aligned}$$

$$\begin{aligned}
 D_x &= v^x l_x, & N_x &= \sum_{t=0}^{\omega-1} D_x, & N_x - D_x &= N_{x+1} \\
 a_x &= \frac{N_{x+1}}{D_x}, & \ddot{a}_x &= \frac{N_x}{D_x} \\
 a_{x:\bar{n}|} &= \frac{N_{x+1} - N_{x+n+1}}{D_x}, & \ddot{a}_{x:\bar{n}|} &= \frac{N_x - N_{x+n}}{D_x} \\
 {}_m | a_x &= \frac{N_{x+m+1}}{D_x}, & {}_m | \ddot{a}_x &= \frac{N_{x+m}}{D_x} \\
 {}_{m|n} | a_x &= \frac{N_{x+m+1} - N_{x+m+n+1}}{D_x}, & {}_{m|n} | \ddot{a}_x &= \frac{N_{x+m} - N_{x+m+n}}{D_x} \\
 S_{x:\bar{n}|} &= \frac{D_x}{D_{x+n}} a_{x:\bar{n}|}, & \ddot{S}_{x:\bar{n}|} &= \frac{D_x}{D_{x+n}} \ddot{a}_{x:\bar{n}|} \\
 a_x^{(m)} &\approx a_x + \frac{m-1}{2m}, & \ddot{a}_x^{(m)} &\approx \ddot{a}_x - \frac{m-1}{2m} \\
 a_{x:\bar{n}|}^{(m)} &\approx a_{x:\bar{n}|} + \frac{m-1}{2m} \left(1 - \frac{D_{x+n}}{D_x}\right), & \ddot{a}_{x:\bar{n}|}^{(m)} &\approx \ddot{a}_{x:\bar{n}|} - \frac{m-1}{2m} \left(1 - \frac{D_{x+n}}{D_x}\right) \\
 {}_n | a_x^{(m)} &\approx {}_n | a_x + \frac{m-1}{2m} \frac{D_{x+n}}{D_x}, & {}_n | \ddot{a}_x^{(m)} &\approx {}_n | \ddot{a}_x - \frac{m-1}{2m} \frac{D_{x+n}}{D_x}
 \end{aligned}$$

$$A_{x:\bar{n}|}^1 = \frac{D_{x+n}}{D_x}, \quad A_{x:\bar{n}|}^1 = \frac{M_x - M_{x+n}}{D_x}, \quad A_{x:\bar{n}|} = A_{x:\bar{n}|}^1 + A_{x:\bar{n}|}^1 = \frac{M_x - M_{x+n} + D_{x+n}}{D_x}$$